

Industrial-process control valves -- Part 9: Test procedure for response measurements from step inputs

Industrial-process control valves -- Part 9: Test procedure for response measurements from step inputs

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 60534-9:2007 sisaldab Euroopa standardi EN 60534-9:2007 ingliskeelset teksti. Käesolev dokument on jõustatud 23.11.2007 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN 60534-9:2007 consists of the English text of the European standard EN 60534-9:2007. This document is endorsed on 23.11.2007 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.
--	---

Käsitlusala: This part of IEC 60534 defines the testing and reporting of the step response of control valves that are used in throttling closed-loop control applications. A control valve consists of the complete, ready-to-use assembly of the control valve body, the actuator, and any required accessories. The most probable accessory is a valve positioner. NOTE For background, refer to technical report ANSI/ISA-TR75.25.02 [6]1. The object of this standard is to define how to test, measure, and report control valve response characteristics in an open-loop environment. This information can be used for process control applications to determine how well and how fast the control valve responds to the control valve input signal. This standard does not define the acceptable control valve performance for process control nor does it restrict the selection of control valves for any application. If this standard is used for evaluation or acceptance testing, the parties may agree to documented variations from these requirements.	Scope: This part of IEC 60534 defines the testing and reporting of the step response of control valves that are used in throttling closed-loop control applications. A control valve consists of the complete, ready-to-use assembly of the control valve body, the actuator, and any required accessories. The most probable accessory is a valve positioner. NOTE For background, refer to technical report ANSI/ISA-TR75.25.02 [6]1. The object of this standard is to define how to test, measure, and report control valve response characteristics in an open-loop environment. This information can be used for process control applications to determine how well and how fast the control valve responds to the control valve input signal. This standard does not define the acceptable control valve performance for process control nor does it restrict the selection of control valves for any application. If this standard is used for evaluation or acceptance testing, the parties may agree to documented variations from these requirements.
---	---

ICS 23.060, 25.040.40

Võtmesõnad:

**Industrial-process control valves -
Part 9: Test procedure for response measurements from step inputs
(IEC 60534-9:2007)**

Vannes de régulation
des processus industriels -
Partie 9: Procédure d'essai
pour la mesure de la réponse
des vannes de régulation
à des signaux d'entrée échelonnés
(CEI 60534-9:2007)

Stellventile für die Prozessregelung -
Teil 9: Prüfverfahren zur Bestimmung
des Verhaltens von Stellventilen
bei Sprungfunktionen
(IEC 60534-9:2007)

This European Standard was approved by CENELEC on 2007-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 65B/632/FDIS, future edition 1 of IEC 60534-9, prepared by SC 65B, Devices & process analysis, of IEC TC 65, Industrial-process measurement, control and automation, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60534-9 on 2007-10-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2008-07-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2010-10-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60534-9:2007 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

**Normative references to international publications
with their corresponding European publications**

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60534-1	– ¹⁾	Industrial-process control valves - Part 1: Control valve terminology and general considerations	EN 60534-1	2005 ²⁾
IEC 60534-4	– ¹⁾	Industrial process control valves - Part 4: Inspection and routine testing	EN 60534-4	2006 ²⁾

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Industrial-process control valves –
Part 9: Test procedure for response measurements from step inputs**

**Vannes de régulation des processus industriels –
Partie 9: Procédure d'essai pour la mesure de la réponse des vannes de
régulation à des signaux d'entrée échelonnés**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2007 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch

Tel.: +41 22 919 02 11

Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch

Tél.: +41 22 919 02 11

Fax: +41 22 919 03 00



INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Industrial-process control valves –
Part 9: Test procedure for response measurements from step inputs**

**Vannes de régulation des processus industriels –
Partie 9: Procédure d'essai pour la mesure de la réponse des vannes de
régulation à des signaux d'entrée échelonnés**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

U

CONTENTS

FOREWORD.....	3
1 Scope and object.....	5
2 Normative references	5
3 Terms and definitions.....	5
4 Symbols	10
5 General test procedures	11
5.1 Test valve conditions.....	11
5.2 Test system.....	11
5.3 Measuring instruments	11
5.4 Process variable.....	12
5.5 Nominal test position.....	13
6 Examples of step response.....	13
7 Tests specified for each of three test environments	15
7.1 Bench tests	15
7.2 Laboratory tests	16
7.3 In-process tests.....	16
8 Detailed test procedures.....	17
8.1 Baseline test	17
8.2 Small-step test	18
8.3 Response-time tests.....	19
9 Presentation of test results	21
9.1 General information.....	21
9.2 Test results	22
9.2.1 Baseline test.....	22
9.2.2 Small-step test	22
9.2.3 Response-time tests.....	22
Annex A (informative) Sliding friction measurement	24
Bibliography.....	26
Figure 1 – Dead band and resolution	6
Figure 2 – Typical step change and response without overshoot.....	14
Figure 3 – Step response with some overshoot.....	15
Figure 4 – Example step and response during baseline test.....	18
Figure 5 – Signal sequence for small-step test.....	19
Figure 6 – Sample signal step sequence for response time tests	20
Figure 7 – Sample data from small-step test ($\Delta s = 0,13 \%$) performed in a process loop	23
Figure 8 – Sample plot showing step response, t_{86} , versus step size for four different valves	23

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL-PROCESS CONTROL VALVES –**Part 9: Test procedure for response measurements from step inputs**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60534-9 has been prepared by subcommittee 65B: Devices, of IEC technical committee 65: Industrial-process measurement and control.

The text of this standard is based on the following documents:

FDIS	Report on voting
65B/632/FDIS	65B/639/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The list of all the parts of the IEC 60634 series, under the general title *Industrial-process control valves*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INDUSTRIAL-PROCESS CONTROL VALVES –

Part 9: Test procedure for response measurements from step inputs

1 Scope and object

This part of IEC 60534 defines the testing and reporting of the step response of control valves that are used in throttling closed-loop control applications. A control valve consists of the complete, ready-to-use assembly of the control valve body, the actuator, and any required accessories. The most probable accessory is a valve positioner.

NOTE For background, refer to technical report ANSI/ISA-TR75.25.02 [6]¹.

The object of this standard is to define how to test, measure, and report control valve response characteristics in an open-loop environment. This information can be used for process control applications to determine how well and how fast the control valve responds to the control valve input signal.

This standard does not define the acceptable control valve performance for process control nor does it restrict the selection of control valves for any application. If this standard is used for evaluation or acceptance testing, the parties may agree to documented variations from these requirements.

The information using the defined test methods is specifically applicable to closed-loop feedback control but may have some application to open-loop control applications. It does not address valves used in on-off control service.

Tests specified in this standard may not be sufficient to measure the performance required for all applications. Not all control valve applications will require this testing.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60534-1, *Industrial-process control valves – Part 1: Control valve terminology and general consideration*

IEC 60534-4, *Industrial-process control valves – Part 4: Inspection and routine testing*

3 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in IEC 60534-1 and other parts of IEC 60534, apply.

NOTE 1 In the specific area of non-linear dynamics, it was determined that some terms defined in IEC 60050-351 or in [5] lacked the precision desired for these documents. Others were inconsistent with the terminology used in the non-linear control literature.

¹ Figures in square brackets refer to the Bibliography.